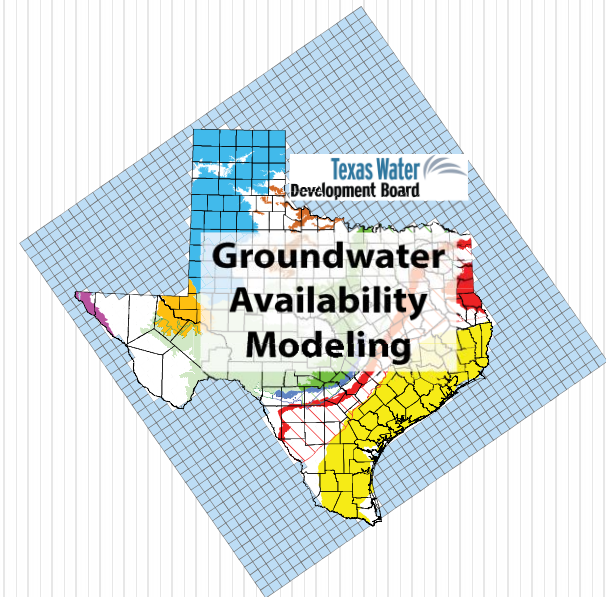


Going From Desired Future Conditions to Modeled Available Groundwater



Overview

- These guidelines apply when a Groundwater Availability Model (GAM) is used to estimate Modeled Available Groundwater (MAG) from desired future conditions (DFCs).
- A GAM is a regional groundwater flow model based on the U.S. Geological Survey MODFLOW code(s) that has been accepted by the Texas Water Development Board (TWDB) for groundwater management uses.
- DFCs, such as specified drawdowns, aquifer thickness, or spring flow, are criteria adopted by member districts of a groundwater management area (GMA) during joint planning.

Overview (cont.)

- The MAG is the amount of groundwater pumping that will achieve the DFC.
- The MAGs will be provided to groundwater conservation districts (GCDs) and regional water planning groups (RWPGs).
- RWPGs express their planning efforts in 10-year increments extending 50 years in the future.
- The next regional plans are due in 2016, with the next State Water Plan due in 2017. This 50 year planning horizon extends to 2070.

Overview (cont.)

- The groundwater pumping, simulated using the MODFLOW well package, is saved in the MODFLOW volumetric budget file. Because the well package and the cell-by-cell budget file may contain different values, the budget file will be used to estimate the MAG.
- The Groundwater Availability Modeling Team at TWDB will use the U.S. Geological Survey program ZONEBUDGET Version 3.01 to process the cell-by-cell budget file. The link to the program is:

<http://water.usgs.gov/nrp/gwsoftware/zonebud3/zonebudget3.html>

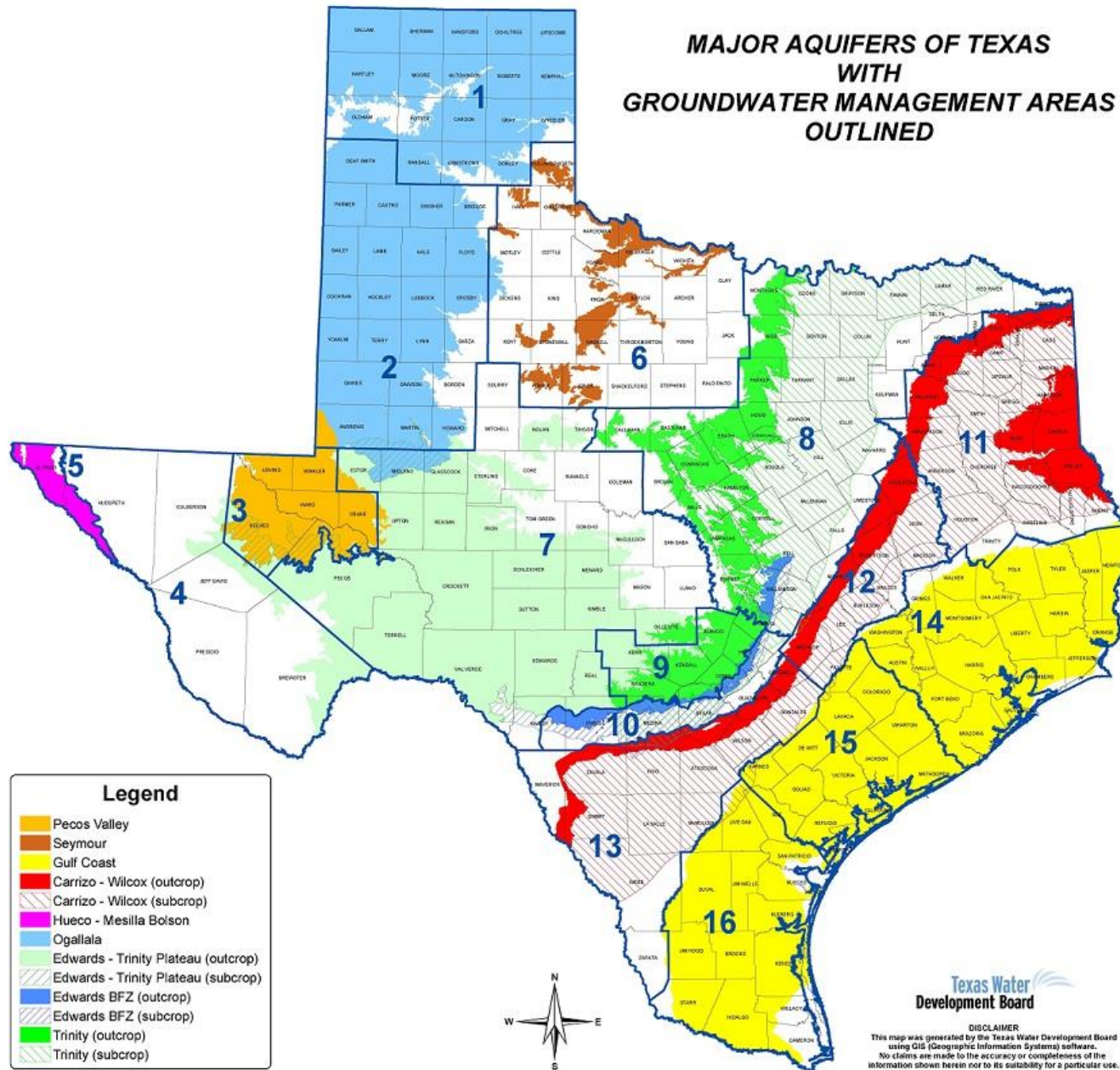
Desired Future Conditions

- Once a DFC submittal is received by TWDB, staff will review the submitted information to determine whether it is complete.
- The review will also include verification that all technical work has been sealed by a licensed Texas geoscientist or engineer.
- After TWDB receives all required data, TWDB staff will determine whether the DFC is achievable. TWDB will notify the GMA if the DFC is NOT achievable.
- Once the DFC is determined to be achievable, TWDB staff will estimate the MAG.

Desired Future Conditions (cont.)

- Unless stated otherwise in the DFC submittal, TWDB staff will calculate averages based on the footprint of the official aquifer boundaries if the DFC is average drawdown or aquifer thickness. For example, if the DFC is stated as an average drawdown over a GMA, TWDB staff will calculate the average drawdown-for all model cells within the GMA only within the official aquifer boundary, even if the GAM extends beyond the official aquifer boundary.
- GIS data of official aquifer boundaries can be found here:
<http://www.twdb.texas.gov/mapping/gisdata.asp>
- For other DFCs such as water levels at a specific monitoring well or specified spring flow, TWDB will evaluate the conditions consistent with the DFC description.

MAJOR AQUIFERS OF TEXAS WITH GROUNDWATER MANAGEMENT AREAS OUTLINED



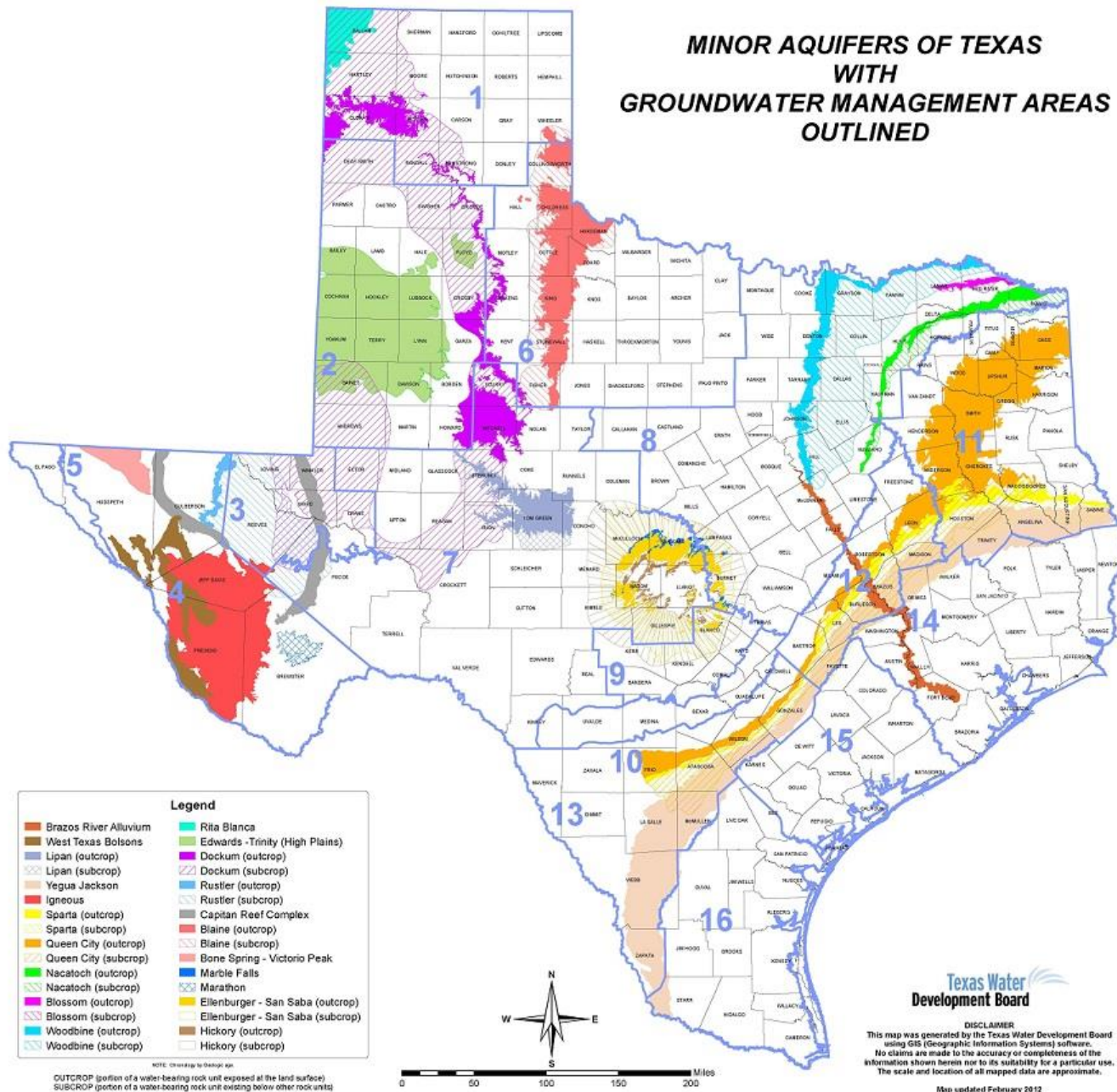
NOTE: Outcrops by orange line
OUTCROP (portion of a water-bearing rock unit exposed at the land surface)
SUBCROP (portion of a water-bearing rock unit existing below other rock units)

**Texas Water
Development Board**

DISCLAIMER
This map was generated by the Texas Water Development Board
using GIS (Geographic Information Systems) software.
No claims are made to the accuracy or completeness of the
information shown herein nor to its suitability for a particular use.
The scale and location of all mapped data are approximate.

Map updated February 2012

MINOR AQUIFERS OF TEXAS WITH GROUNDWATER MANAGEMENT AREAS OUTLINED



**Texas Water
Development Board**

DISCLAIMER
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Average Drawdown Calculation

- For each model cell, drawdown will be calculated as the difference between water levels at a reference year and water levels at a target year.
- The DFC submittal or supporting documentation needs to specify which model stress periods correspond with the reference and DFC target years.
- The reference year must be sometime in the past and should not be the current year or sometime in the future.
- If a reference year or the DFC target year is not specified in the submittal, the submittal will be considered incomplete and TWDB staff will contact the GMA representative for the additional information.

Average Drawdown Calculation (cont.)

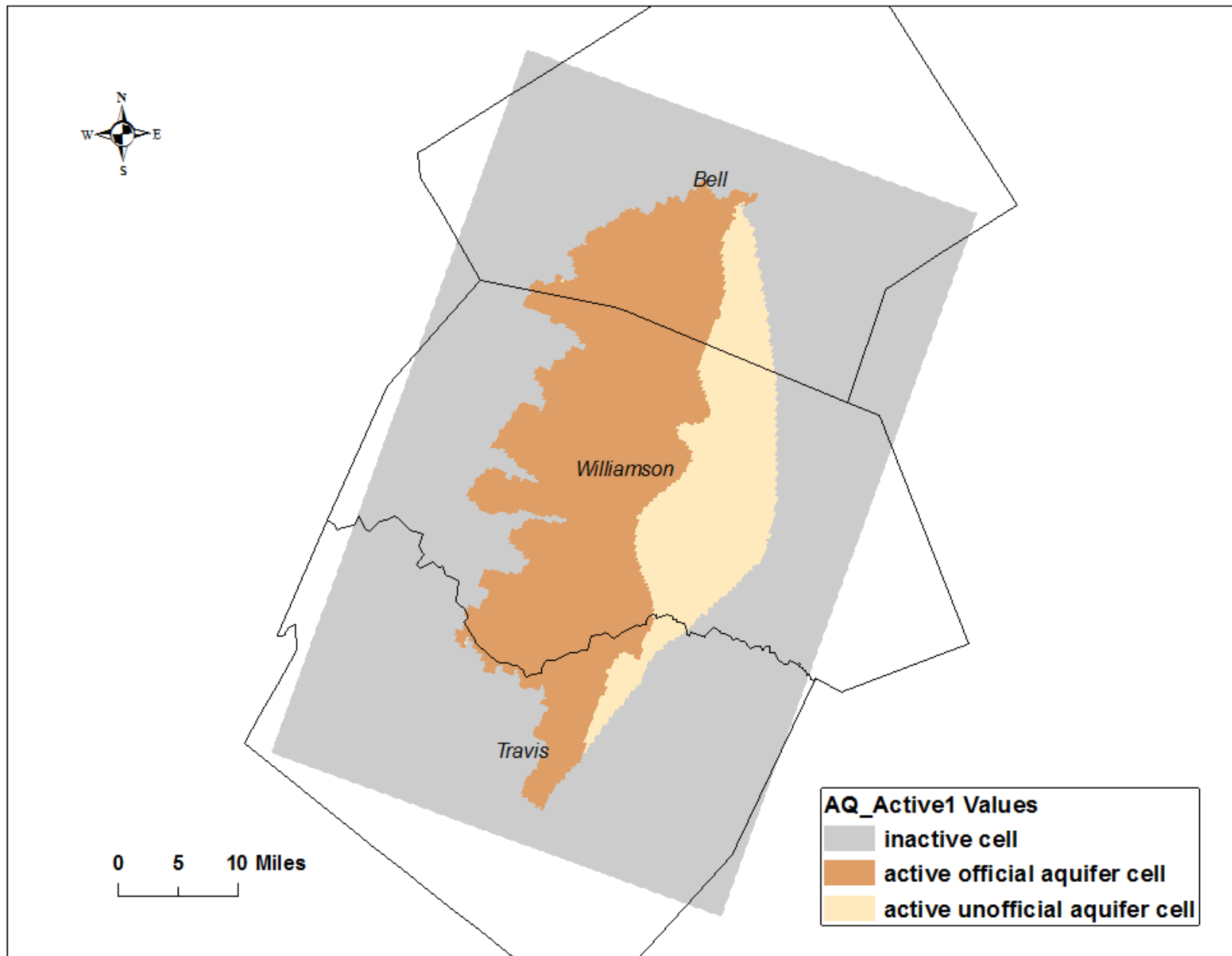
- The drawdown values for all active official aquifer cells in a specified area will be summed and divided by the number of active official aquifer cells in that area.
- A model cell with simulated head below the cell bottom at either the reference year or the DFC target year will be excluded from the calculation.
- The specified area is the area stated in the DFC such as county, GCD, or entire GMA. It may be for an individual aquifer unit or model layer or for all layers.

Model Grids

- Each GAM has a GIS grid with attributes for various geographic designations, such as county, GMA, GCD, and active or inactive cells. These grids can be found at <http://www.twdb.texas.gov/groundwater/models>
- The grid file also includes aquifer boundary or layering information in fields with the header “AQ_Active”. There is an “AQ_Active” field for each model layer. Integer values have been assigned to model cells to identify whether the cells are active or inactive, within or outside an official aquifer boundary, or some other hydrostratigraphic designations.
- In general, an AQ_Active value of “0” indicates a model cell is inactive, a value of “1” indicates the model cell is active and within the official aquifer boundary and a value of “2” indicates the model cell is active but represents something other than the official aquifer.

Model Grids (cont.)

- Other AQ_Active values may be assigned depending on how various hydrostratigraphic units are represented in the model.
- *Detailed documentation of AQ_Active values and what they represent for each model grid is being developed and will be available with the model grids in 2014.*
- Please note the date of the grid that was used.
- It should be noted that for the Gulf Coast Aquifer, model areas located under bays are also excluded even though they are active model cells within the official aquifer boundaries.
- An example of the AQ_Active designations for the GAM for the northern segment of the Edwards (Balcones Fault Zone) Aquifer follows.



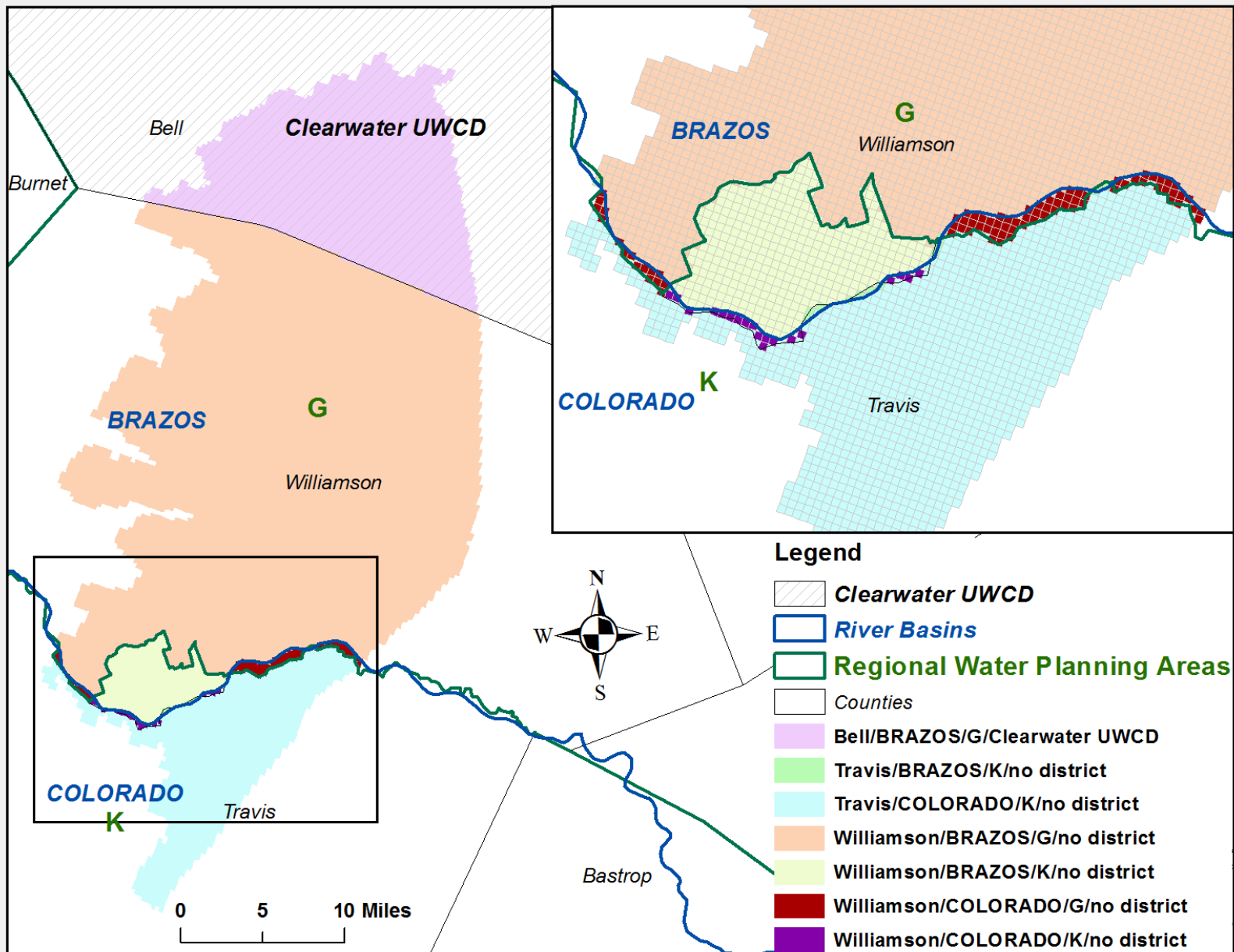
AQ_Active designations for the GAM for the northern segment of the Edwards (Balcones Fault Zone) Aquifer

ZONEBUDGET

- The U.S. Geological Survey program ZONEBUDGET extracts MODFLOW cell-by-cell flows based on a zone file. The zone file may contain different zones represented by integers at model cells. The program calculates flows within and between zones.
- TWDB staff will use the model grids to construct zone files for the program ZONEBUDGET to extract the well flow from the MODFLOW volumetric budget file for all model cells.
- For MAGs, TWDB delineates the zones based on county, river basin, regional water planning area, GCD, GMA splits, and any other specified areas in the DFC resolution. Thus, MAGs will be provided under different categories to meet different planning purposes.

ZONEBUDGET (cont.)

- The model GIS grid files discussed above include geographic locations for each model grid cell based on the location of the model grid cell centroid.
- Again, unless otherwise stated in the DFC submittal, MAG values (groundwater pumping) will only be extracted from the model within the official aquifer boundaries.
- Note: in most cases for the previous round of DFC/MAGs (September 2010), TWDB estimated MAGs based solely on the model active area.
- An example of zone splits for the northern segment of the Edwards (Balcones Fault Zone) Aquifer in GMA 8 follows.



Zone splits for the northern segment of the Edwards (Balcones Fault Zone) Aquifer in GMA 8

**Modeled Available Groundwater for the northern segment
of the Edwards (Balcones Fault Zone) Aquifer.**

County	Regional Water Planning Area	River Basin	Groundwater Conservation District	Modeled Available Groundwater (acre- feet per year)
Bell	G	Brazos	Clearwater	6,469
Williamson	G	Brazos	no district	3,351
Williamson	G	Colorado	no district	101
Williamson	K	Brazos	no district	6
Williamson	K	Colorado	no district	4
Travis	K	Brazos	no district	275
Travis	K	Colorado	no district	4,962

Questions or Concerns

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or

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